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NJOY and MCNP

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Using New Data

- **Updated ^{238}U from ENDF/B-VIII.0**
  - How does this affect your calculation?

- **Exercise:**
  - Process ENDF/B-VIII.0 evaluation for ^{238}U into an ACE file.
  - 92u238 directory contains evaluation file

  - Start with NJOY input deck for ^{235}U

Solution

- Replace all instances of ^{235}U material number (9228) with ^{238}U material number (9237)

```
moder
 1 -21/                                                  card1
 'moder iopt=1, extract mat 9237 from input tape'/card2
 20 9237/                                                card3
 0/                                                      repeat card3, 0=moder is done
reconr
 -21 -22/                                                card1
 'reconr/pendf tape for mat 9237'/                       card2
 9237 7/                                                 card3
 .001/                                                   card4
                 ...
 0 /                                                     repeat card3, 0=reconr is
broadr
 -21 -22 -23/                                            card1
 9237 1 0 0/                                             card2
 .001 -2E4/                                              card3
 293.6                                                   card4
 0/                                                      repeat card2, 0=broadr is done
```

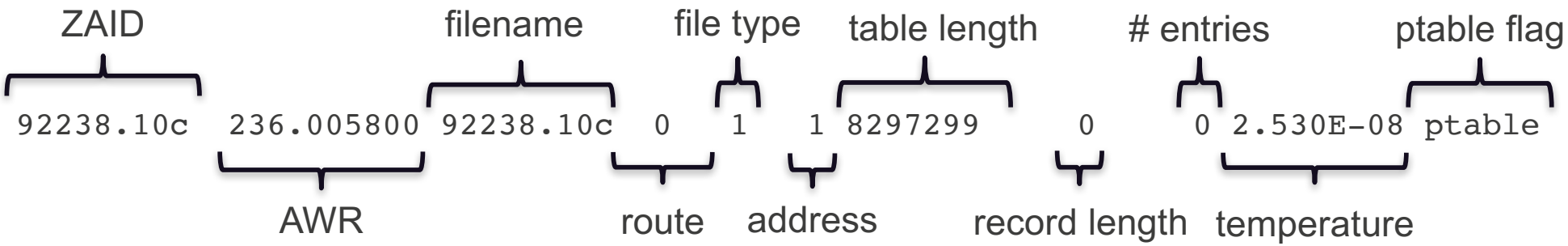
Using One-Off Data in MCNP

- **Rename/move ACE file**
  - tape34 in this exercise
  - Place file (92238.10c) in same directory as MCNP input deck

- **Use the `XSn` card in MCNP**
  - `n` 1 to 999
  - The entries for the `XSn` card are identical to those in XSDIR (tape35 in this exercise)

```
92238.10c  236.005800 92238.10c  0   1   1 8297299     0     0 2.530E-08 ptable
```

XSDIR Entry



1. **ZAID**
2. **Atomic Weight Ratio**
3. **Filename of ACE file**
4. **“Route” to ACE file (zero if no path)**
5. **File Type (1 or 2, ascii or binary)**
6. **Address—on what line does the data begin**
7. **Table length—How many numbers in table**
8. **Record length (unused for Type 1)**
9. **Number of entries per record (unused for Type 1)**
10. **Temperature (MeV)**
11. **Probability Table flag—whether or not there are probability tables**

Comparing k_{eff} results

	ENDF/B-VII.1	ENDF/B-VIII.0
Big10	1.00432 (33)	1.01269 (37)

Doppler Broadening Energy Limits

- **From the NJOY manual:**

```
! thnmax A possible upper limit for broadening and thinning.
! The actual upper limit is the lowest of (i) this input
! value; (ii) the end of the resolved resonance range;
! (iii) the lowest reaction threshold; or (iv) 1.0 MeV.
!
! A negative value for thnmax forces the Doppler
! broadening upper limit to be abs(thnmax) irrespective
! of the other conditions.
```

- **End of resolved resonance range:**
  - 20 keV
- **Lowest threshold reaction:**
  - ~40 keV in ENDF/B-VII.1
  - ~0.1 keV in ENDF/B-VIII.0

How to find End of Resolved Resonance Range

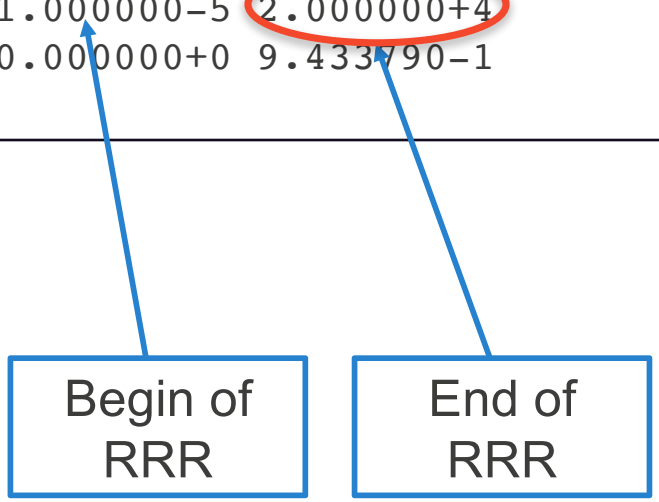
- **Save RECONR results in ascii format**

```
reconr
 -21 -22/                                              card1
 'reconr/pendf tape for mat 9237'/                     card2
 9237 7/                                               card3
 .001/                                                 card4
 'the following reaction types may be added'/          card5 (repeat 7 times)
 '     mt152   bondarenko unresolved'/
 …
 0 /                                                   repeat card3, 0=reconr is done
-- Save output from RECONR
moder
 -22 52/                                               /card1
```

How to find End of Resolved Resonance Range

- **Look at MF=2, MT=151 in output**

```
                                                                 9237 0  0    0
9.223800+4 2.360058+2          0          0          1          09237 2151    1
9.223800+4 1.000000+0          0          0          1          09237 2151    2
1.000000-5 2.000000+4          0          0          0          09237 2151    3
0.000000+0 9.433790-1          0          0          0          09237 2151    4
                                                                 9237 2  099999
```



Exercise

- **Modify your NJOY input deck to Doppler broaden to correct limit**

Solution

```
broadr
 -21 -22 -23/                                    card1
 9237 1 0 0/                                     card2
 .001 -2E4/                                      card3
 293.6                                           card4
 0/                                              repeat card2, 0=broadr is done
```

Comparing k_{eff} results

	ENDF/B-VII.1	ENDF/B-VIII.0	ENDF/B-VIII.0-2
Big10	1.00432 (33)	1.01269 (37)	1.00599 (36)

That's better

Adding Data to MCNP's Data

- **Move ACE files some place under `DATAPATH` directory**
  - Place inside a directory (`myACEFiles`)
  - Add entry to `XSDIR`

```
 92238.10c  236.005800 myACEFiles/92238.10c 0 1 1 8297299 0   0 2.530E-08 ptable
```

- **`XSDIR` directory order is important**
  - MCNP searches from the top until it finds a matching ZAID

```
directory
1001.90c 0.999167 endf71x/H/1001.720nc 0 1 4 8177 0 0 2.530100E-08
1001.91c 0.999167 endf71x/H/1001.721nc 0 1 4 8177 0 0 5.170400E-08
    ...
  sio2.10t   27.737000 ENDF71SaB/sio2.10t 0 1 1 2010074     0     0 2.530E-08
  sio2.11t   27.737000 ENDF71SaB/sio2.11t 0 1 1 1968401     0     0 3.016E-08
    ...
1001.80c 0.999167 endf71x/H/1001.710nc 0 1 4 17969 0 0 2.530100E-08
1001.81c 0.999167 endf71x/H/1001.711nc 0 1 4 17969 0 0 5.170400E-08
1001.82c 0.999167 endf71x/H/1001.712nc 0 1 4 17969 0 0 7.755600E-08
```